



CONTRIBUTIONS TO A MORE EXACT KNOWLEDGE
OF THE GEOGRAPHICAL DISTRIBUTION OF
AUSTRALIAN BATRACHIA. No. II.

BY J. J. FLETCHER.

In this second small contribution I am able to supply some supplementary details of interest, to record several additional collections from localities in New South Wales west of the Dividing Range—as well as two from Victoria; and to give some interesting facts kindly communicated to me by two of our members, about the habits of several inland species which town residents rarely get the chance of observing in the natural haunts. Though the number of species (eighteen) previously recorded from the inland division of the colony is not increased, the particulars now given offer additional evidence of wide distribution.

(i.) *The Coastal Division of N.S.W. (East of the Dividing Range).*

(a *bis*). From Dunoon, Richmond River (collected by R. Helms).

Hyla phyllochroa, Gthr.

Hyla gracilentia, Ptrs.

During a second visit to Dunoon, early in this year, Mr. R. Helms obtained and kindly forwarded to me alive one example of the former, and a number of specimens of the latter, both additions to the fauna of the district, and the second of them to New South Wales as well, the species having been previously recorded only from Queensland (N. E. Australia and Port Bowen by Peters; Rockhampton, in B. M. Catalogue; specimens obtained for the Macleay Museum by Mr. Froggatt at Cairns were exhibited at a Meeting of this Society in August, 1886). About the same time Mr. A. Sidney Olliff kindly handed over to me two specimens of

the same species from Grafton, collected and forwarded by the Right Rev. the Bishop of Grafton.

H. gracilentata appears to be another example of species like *Chiroleptes australis* and others whose stronghold according to present knowledge is Queensland, and which find their southern limit somewhere about the northern boundary of New South Wales. It is a very beautiful frog when alive; the iris has an inner portion golden shading into a circumferential ring of bright coppery-red (visible sometimes even in spirit specimens); the body above green or yellowish-green; in the males the throat, part of upper arm, shoulders, a line along the flanks bright yellow; the under surface of the body and limbs tinged with yellow; the back of thighs purplish. The "white line on canthus rostralis, outer border of upper eyelid, and above the tympanum" of Mr. Boulenger's description is absent in my specimens.

Mr. Helms says "this species may almost be called arboreal; most of the specimens were found on the leaves of the arrow-root plant; during the day time they sit quite still with their eyes closed, probably asleep; when kept in the dark they assume a much darker colour." I kept some specimens alive for some time in a vivarium along with specimens of *H. caerulea*; individuals of both species during the day time were invariably asleep, either perched on the leaves of an Arum, or adhering to the sides of the vivarium—to glass or wood indifferently.

(d *bis*). From the Blue Mts.

Hyla aurea.

Four specimens of this species were found by me last month near Springwood, the first time I have happened to meet with it on the Blue Mts. In the same locality in December last Mr. Sloane and myself found two couples of *H. citropus* in cop., in a little pool overshadowed by a fallen tree-trunk in a gully. This is the first time I have seen this species from anywhere on the Blue Mts., except Mt. Wilson.

(ii.) *The inland division of N.S. W. (West of the Dividing Range).*

(m) From Goangra and Euroka, near Walgett on the Namoi (collected by Messrs. A. Carson, and J. H. Rose).

<i>Limnodynastes salminii</i>	<i>Hyla cærulea</i>
<i>Chiroleptes platycephalus</i>	<i>peronii</i>

Living specimens of all the above were exhibited at the Society's Meetings in February and March last. As I then pointed out, the stripes on the back which in spirit specimens of *L. salminii* are pink or rose-red were in the living animals of quite a different tint, a bright ochreous-yellow; when put into spirit subsequently the colour soon changed, the glandular fold from the eye to the shoulder, and a patch on each upper arm also assuming the rosy tint, as well as part of the upper eyelids. *Notaden* also occurs in the Walgett district, but specimens did not happen to be procurable at the time the others were forwarded. Mr. Rose has very kindly furnished me with the following particulars about this species.

“*Notaden bennettii*, the ‘Catholic frog’ or, as I have heard it called, the ‘Holy Cross toad’ I first noticed in January, 1885, after a heavy fall of rain lasting ten days, off and on, and succeeding a long and severe drought. I was living at that time on the Merri Merri Creek, 36 miles from Coonamble. These toads were then very plentiful, and seemed to come out of the earth. I have seen them all over the plain country, both on black and sandy soil. Here at Euroka I have dug them out of a soft loamy flower bed in front of the house at a time when the earth was commencing to get dry; during comparatively dry periods they disappear, but reappear as soon as a few points of rain have fallen. I can safely say they were to be found here at all times during the last twelve months, though at times during the hottest part of summer only under logs and in damp places. After a heavy fall of rain in summer they simply swarm. I should certainly incline to the opinion that it is always about if not too dry. I have seen it as far south as Forbes. Some that I have seen have

been very much lighter in colour than others ; one could truthfully have called them yellow. They hop along with short quick strokes ; and if teased or interfered with will stand up with bodies above the ground on all fours, and puffing themselves out to an absurd size will face their tormentor in a defiant manner."

"I can verify the statement of your correspondent that *Notaden* is partial to ants, for I have repeatedly unearthed them, and fed them upon the wood-destroying white ants, which they ate in large quantities refusing however any that were dead. I also tried them with the carrion ants, giving them eggs, pupæ, workers, and winged ones. The last-mentioned were soon disposed of, the eggs and pupæ taken into the mouth and ejected, but the workers they refused to touch. I tried them with other food such as insects, grubs, &c., but did not observe them to eat any. Perhaps their partiality for white ants explains their being frequently plentiful about homesteads, deserted yards, and buildings."

As further confirmation of the fact that *Notaden* preys upon ants, I may say that the bottle in which eleven living specimens were forwarded to me from Trangie, as noted below, by the Rev. J. M. Curran, F.G.S., contained on opening a noticeable quantity of undigested fragments of ants voided by the toads while in transit.

Mr. Curran has also very kindly furnished me with the following observations:—"On two occasions recently I have noticed large numbers of 'Hervy's frog' (*Notaden bennettii*) on the Macquarie River, about four miles down stream from the locality known as the Macquarie Cataract. On each occasion there had been recent rather heavy rains. Before the rain no frogs were visible, but after a downpour of five hours the frogs appeared in thousands. On Monday, January 26th, 1891, I rode from the Macquarie to the Ewenmar Creek, and for some twelve miles of well-grassed country a dozen specimens could have been easily collected at any one place over the whole distance. Tuesday was fine, and on the return journey I did not see a single specimen. I noticed the same frogs plentiful in November, 1890, about

Tenandra also after rain. The settlers say that it was just seven years before that the frogs were seen in such large numbers. I heard on good authority that the blacks used to use these frogs for food. I myself saw an old gin seemingly enjoy as a dainty morsel the muscular thighs of the frog, eating them quite raw with a little salt. They are called Hervy's frog from a fanciful resemblance of the pattern on the creature's back to the letter H, this being Mr. Hervy's sheep brand."

Notaden when alive is a batrachian of quaint and striking appearance; immersion in spirits, however, very soon produces a washed-out effect, the bright tints (yellow, red, and green) being entirely discharged or much bleached; ordinary spirit specimens thus quite fail to suggest, or at least in the forcible manner which the examination of the living animal almost immediately does, that *Notaden* is probably an example of "warning coloration" not unworthy to rank with Darwin's small Brazilian toad, or Belt's now historic little Nicaraguan frog. The dorsal surface presents a characteristic and very fairly constant pattern which, from the inspection only of spirit specimens, has been described as due to the presence of "a large cross-shaped blackish marking on the back" (Boulenger): or, as Dr. Günther puts it, "a very broad brownish band, marbled with black, along the middle of the back; it bifurcates anteriorly on the head, leaving the forehead greenish, and emits a transverse bar on each side of the back behind the shoulder": this constitutes the cross-pattern to which are due two of the local vernacular names by which the animal is known. In the lumbar region, however, as indicated in fig. 3 of Pl. XXII. of the B. M. Catalogue (2nd edition), the median band emits another transverse band on each side, whence arises the H-pattern referred to in Mr. Curran's remarks, the H being thus placed transversely with regard to the animal's back. Inspection of the living animal at once renders it obvious that the characteristic pattern is not quite satisfactorily expressed in the quotations given above. Rather is it due to an arrangement of very dark (black) not very much raised glandular warts or papillæ of several sizes, together with small isolated spots and patches of ferruginous or orange-red,

and in places white spots, on a greenish background, the pattern being thrown up and emphasised by contrast with sundry symmetrically arranged insular areas free, or almost so, from papillæ, and of a lighter tint, bright yellow or greenish-yellow. The largest warts for the most part outline the pattern, and border the insular patches; there is little more than only an anterior edging of them in the posterior or lumbar limb of the H; the others with the red spots and patches, and in the lumbar band and on the flanks white spots, are scattered over the surface so outlined; from behind the eye downward and outward to the shoulder and along the sides and flanks on each side is another dark band, but with fewer, more scattered and still smaller papillæ, some of them particoloured—black and white. Thus six areas wholly without warts, or occasionally with a large one here and there, are enclosed, and these, as mentioned above, are of a lighter and yellower tint: two of them are median, an anterior cruciform or dagger-shaped one between and behind the eyes, and a posterior coccygeal narrow band, these two representing the bifurcation of each end—a little extended—of the cross-bar of the H: the others are in pairs, an anterior pair in front of, and a larger posterior pair behind, the anterior limb of the H. The outer surface of the arms and legs, especially the latter, are also spotted with red, and the back of the thighs with white on a dark ground.

Looked at in the laboratory, for example in a white dish, *Notaden* is brightly coloured and conspicuously marked; when placed on the grass of the lawn, however, the animal was very much less conspicuous, and as long as it kept still even a good observer unaware of its presence and unfamiliar with the animal might, I think, have passed close to it without noticing it. Nevertheless there seems little need to doubt that we have here a case not of *protective*, but of *warning* coloration. The former would probably have been amply provided for as in some green tree-frogs, by a more or less uniform livery of green or greenish-yellow, without the elaborate arrangement of coloured papillæ, and specks, &c., which is present; neither are the grass-lands of the interior quite like well kept city lawns.

Moreover, as implied in Dr. Günther's name, "not only the skin of the paratoid region, but that of the entire back is thickened by numerous glands;" from these there exudes under certain circumstances a copious yellow secretion; Mr. Rose tells me that he has sometimes observed the exudation when handling the toads, and I noticed it in several specimens put into spirit, and also in a specimen which had but recently died. On the supposition that, as in other toads in which such is known to be the case, the glandular secretion is acrid and renders the animal nauseous and inedible (except perhaps to blackfellows who would soon learn to avoid the integument of the part eaten), and taking into account also the animal's habit of puffing itself out when interfered with, and the conspicuous colour and remarkable character of the markings seen at close quarters, it is possible that not many experiments would be necessary to teach snakes, predaceous birds, or maybe some of the larger lizards to grasp the situation. Such an immunity from attack would also render intelligible the unusual habit—unknown as yet in the case of any other Australian frog—of appearing at times in great numbers in the open, and in the day time, without any attempt at concealment, as established on the independent evidence of capable observers. This point, however, I hope to be able to settle at no very distant date by actual experiment.

Of *Chiroleptes platycephalus*, Gthr., Mr. Rose says "this frog is also a burrower; I have found it in a well-formed hollow just large enough to contain the animal comfortably, about one foot underground. I have dug up some scores of them, but I never found any water in the cavities containing them (*i.e.* as Mr. Aitken says is to be found in the clay balls formed by certain frogs in tropical Australia in which they sojourn during droughts); neither is the surrounding earth particularly hard except just in a dry season; just now (May) the walls of the cells are about as hard as potter's clay after the turning-table period, and before being dried. I send you a portion of one of the cavities which contained a specimen of *Chiroleptes*, and from the knife marks you will see that it was not particularly hard when first found."

Mr. Rose kindly forwarded me two lots of living specimens in tins of earth, and I kept them also for some time in a vivarium with a layer of earth on the bottom sufficiently deep to allow them to burrow comfortably out of sight. On turning them out of the tins of earth in which they came they were found snugly ensconced in little chambers below the surface; the soil being clayey it appeared to me as if after having reached the bottom of the tin the frogs, perhaps by puffing themselves out, and by turning themselves round and round, had succeeded in pushing back the earth, and by pressure in puddling the clay to some extent, so forming a little chamber with firm walls, a supposition to which the portion of the chamber sent me by Mr. Rose also lends support. Those kept for some time alive by me were, except for a short time in one solitary instance, not on view during the day time. Partly owing perhaps to nocturnal habits, and partly to burrowing habits, Mr. Rose tells me that he has rarely met with them above ground—once on a wet night, and once in the case of a specimen which fell into a box let into the ground from which it was unable to make its way out. Like *Notaden* it has the habit of puffing itself out when interfered with; and a similar statement is applicable to a specimen of *C. australis* referred to below. In keeping with its retiring habits, *C. platycephalus* is clad in sombre tints, which are not very seriously interfered with by the action of alcohol; my specimens when alive might have been described as above of an olive-grey or greyish-brown much freckled with darker spots and blotches, but without any definite pattern; beneath white, the throat of the male slightly and finely dotted with darker.

This may perhaps be the species referred to in a letter to the *Australasian* of date August 2nd, 1890, as occurring on the Paroo, of which the writer says “all those that I saw were found not in, or very near, water, but at from 6-12 inches below the surface of the ground, each in a cavity just large enough to contain it, a great peculiarity being that for several inches all round the earth was caked as hard almost as a brick. Native name of Darling blacks ‘cowari.’”

Mr. Boulenger gives as a generic character of *Chiroleptes* "pupil vertical." In the six specimens of *C. platycephalus* already referred to, and in one of *C. australis*, from Herberton, Queensland—some of which were exhibited at the Meetings of this Society in March and April of this year—all examined alive and in a strong light, the pupil was certainly horizontal and not vertical. My determination of the species may of course be incorrect, though taking the other characters into consideration I do not think so.

No doubt most, if not all our frogs, under stress of droughts can or do betake themselves to burrowing when aestivating. This is the case for example with *Pseudophryne bibronii*, a feeble little toad, and one which is certainly not habitually a burrower. But *Limnodynastes dorsalis*, *Notaden bennettii*, *Chiroleptes platycephalus* and *Heleioporus pictus* are habitual burrowers. I have seen specimens of each of these species either actually burrow in earth, or go through the burrowing motions in a dish when I have had them under observation, in this case evidently a little surprised at the futility of their efforts; the hind legs in burrowing are moved outwards and downwards, either alternately or simultaneously, the shovel-shaped metatarsal tubercle evidently coming into play. All these species have the metatarsal tubercles of this character, the presence of which may I think be taken as *primâ facie* evidence of the burrowing propensity of their possessor. I have not seen *Limnodynastes ornatus* and *Heleioporus albopunctatus* alive, but from analogy these will also probably turn out to be burrowers.

L. dorsalis, judging from the abundance of croakers, must be one of our most abundant Sydney frogs; yet it is precisely one of the species of which under ordinary circumstances it is most difficult to procure specimens; a condition which is probably largely due to its nocturnal and burrowing habits. Once and only once I found a specimen under a stone; the only other way in which I have obtained specimens about Sydney is by going into the water after them when breeding, individuals at such times often allowing themselves to be caught without much difficulty. On the other hand, except in very dry weather, *L. tasmaniensis*

and *L. peronii* are generally obtainable without difficulty always in the cool months sheltering under logs and stones ; and I know of no reason whatever for supposing that with us they are at all addicted to burrowing otherwise than exceptionally and as a last resource for æstivating purposes. Mr. Rose tells me as follows : " I have taken some notice lately of *L. salminii*, and I cannot find that it burrows like *Notaden* and *Chiroleptes*; it finds its way under logs and pieces of bark, lying very close but not appearing to have made any attempt at excavation ; the same is true of the green frog (*Hyla cærulea*)."

(n) From Bearbong, Munderoran, on the Castlereagh (collected by Messrs. W. L. Gipps, and G. Macguire, and forwarded to me by Mr. F. A. A. Skuse).

<i>Limnodynastes salminii</i>	<i>Pseudophryne bibronii</i>
<i>tasmaniensis</i>	<i>Hyla cærulea</i>
<i>Hyla rubella</i> (one specimen, juv.)	

(o) From Trangie (collected by the Rev. J. Milne Curran, F.G.S.).

Notaden bennettii.

Eleven living specimens were exhibited at the Society's Meeting in December last.

(p) From Kiacatoo Station, on the Lachlan 20 miles below Condobolin (collected by Mr. T. G. Sloane).

<i>Limnodynastes salminii</i>	<i>Hyperolia marmorata</i>
<i>tasmaniensis</i>	<i>Crinia signifera</i>
<i>Hyla peronii</i>	

(q) From Emu Plains, Urana, about 18 miles from the Murrumbidgee at Narrandera (collected by Mr. T. G. Sloane).

<i>Limnodynastes tasmaniensis</i>	<i>Crinia signifera</i>
<i>dorsalis</i>	<i>Heleioporus pictus</i>
<i>Hyperolia marmorata</i>	<i>Hyla aurea</i>

Heleioporus pictus is not conspicuously coloured, resembling some specimens of *L. dorsalis*. The specimen sent me by Mr. Sloane when alive might be described as follows:—Pupil erect; iris silvery or golden veined with black, the anterior half with a dark horizontal mark forming with the contracted pupil an incomplete cross (cf. the complete cross in *Hyla peronii*, as already pointed out by Dr. Günther). Colour above pale olive with darker spots and patches, tolerably uniform but lighter on the flanks and limbs, and with a wash of bright yellow about the thighs and upper arms, a faint light vertebral line; beneath blotched on each side of the throat [no dark streak from the tip of snout to the eye in this specimen]. Fingers free, toes fully webbed, the webbing extending to the tips of the digits; [Mr. Boulenger says “toes two-thirds webbed;” in my Mudgee specimen the toes might be said to be about two-thirds webbed, but I know this specimen was put into strong spirit, and I fancy the webbing is somewhat shrunk.] The specimen is a breeding male, 40 mm. long from snout to vent; as in *Limnodynastes* there are two brownish rugosities on the inner side of the two inner digits of each hand; inner metatarsal tubercles black. Mr. Sloane found the specimen lying very close in a small cavity, with only his back visible, under a log close to the edge of a swamp.

We know so little of Victorian frogs [Professor McCoy has figured three more or less cosmopolitan species in Decade v. of the Prodomus of Victorian Zoology; and seven are recorded in Mr. Boulenger's Catalogue, or in the second of two supplementary lists] that no apology, I think, is needed for recording the two following collections.

Crinia signifera does not appear to have been previously recorded, though judging from the presence of twelve specimens in Mr. Froggatt's collection, it would seem to be as common in Victoria as elsewhere.

(a) From Benalla, Victoria (collected by Mr. T. G. Sloane).

Limnodynastes dorsalis

Crinia signifera

Pseudophryne bibronii

(b) From Ballarat, Victoria (collected by Mr. W. W. Froggatt).

<i>Limnodynastes tasmaniensis</i>	<i>Crinia froggatti</i> , Fl.
<i>Crinia signifera</i>	<i>Pseudophryne bibronii</i>
<i>Hyla ewingii</i>	

This collection comprised sixty-two specimens, of which half were tree-frogs which I take to be the typical form of *Hyla ewingii*, that is to say, the form which is entirely devoid of large dark spots on the flanks, groin, or hinder sides of the thighs, a species recorded from Melbourne in the B. M. Catalogue. As the statements made by different authors as to the characters and distribution of *H. ewingii* disagree in several not unimportant points, I propose to offer some remarks on this subject on a future occasion. I may here remark that Mr. Froggatt brought me one *Hyla* alive because of its different appearance compared with the others. It is a beautiful little frog, light silvery bronze above, reminding one something of *H. dentata*, but with a bright green broad band down the back (and specks of green elsewhere), a not very well defined dark band commencing at about the level of the shoulder edging the green on each side, and another similar lateral band on the flanks soon disappearing. Whether this is *H. ewingii* or a variety of it, or whatever else it may be, I leave for further consideration.